

LUCAS & CO.
Chartered Patent Agents
European Patent Attorneys

Fax: INT+44+1883+622997
e-mail: mail@lucas-uk.com

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135 WESTHALL ROAD
WARLINGHAM
SURREY CR6 9HJ
ENGLAND

Telephones: 01883-626211

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The European Patent Office
Erhardtstrasse 27
D-80298 Munich
Germany

Dear Sirs

re: PCT Patent Application No. PCT/GB2003/004469
(Filed 16th October 2003) based on
UK Patent App No. 02 241 56.0 filed 17 Oct 2002 SC,044-UK
UK Patent App No. 03 015 08.8 filed 23 Jan 2003 SC,091-UK
USSN 10/429,263 filed 2nd May 2003 SC,061-C1-PCT
Varco I/P, Inc.
Inventor: George Alexander BURNETT, Kenneth Wayne SEYFFERT
A Screen Assembly for a Shale Shaker
[Tray and defected Screen panel]
Case: SC,044-PCT

In reply to the Written Opinion of 30th March 2004, we are filing herewith, in triplicate, an amended set of claims and amended introductory pages 4 to 10 to replace pages 4 to 10 currently on file.

D2 discloses a pretensioned type screen assembly having a plurality of support ribs, as discussed on page 2 of the introduction and thus forms the precharacterising portion of claim 1.

D1 WO 00/00264, Southwestern Wire Cloth, Inc. discloses a pretensioned type screen assembly having pretensioned mesh adhered to a planar top surface of a support frame. The support frame has a concave underside, such that it mates with crowned ribs in a hook-strip type shale shaker, so that a flat pre-tensioned screen can be used in a shale shaker designed for hookstrip type screen assemblies.

GB-A-2,176,424, Thule United Limited, discloses a vibratory separator having a basket and channels arranged on internal faces of the basket for receiving a screen assembly and a clamping device. The screen assembly comprises screening mesh laid over and fixed to a frame. The clamping device comprises a frame of similar dimensions to the frame of the screen assembly. The

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frame has an inflatable stocking thereon, which is attached to pneumatic or hydraulic fluid supply means. When both the screen assembly and the clamping device are slid into the channels, the stocking is inflated to fix the screen assembly in the channels. There is also disclosed a clamping device having an intermediate frame member on which a tributary of the stocking is arranged. Support members are provided above and below the screen assembly so that, in use the tributary is inflated to clamp the screen assembly between the supports.

The screen assembly differs from D2 in that the panel is removable from the support structure and wherein at least one member is arranged between the panel and the support structure within the perimeter of the panel over which the panel is deflectable, such that at least two spans are defined by the panel.

The advantages that flow from this are that the replaceable element i.e. the panel comprising the screening material can be made much less rigid than for a screen assembly having a larger span and thus much cheaper to produce and easier to handle. Further, by having at least one member within the perimeter of the panel over which the panel is deflectable, the flow of material to be separated over the surface of the layer of screening material is not compromised, unlike the flow of material around the clamping device disclosed in Figure 4 or 5 in GB-A-2,176,424. Also, the screening area is increased within the same footprint, as there are no clamping devices compromising the screening area.

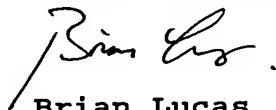
Embodiments no longer falling within the scope of the amended claims will be deleted in the national phase, if required by the relevant national law. Divisonal applications may be filed in due course directed to the embodiments not covered by the amended claims.

Claims 32 and 33 have been introduced, the basis for which can be found on page 9, lines 8 to 13 of the application as filed.

The method claim has also been amended and the claim to the panel has been deleted.

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Yours faithfully



Brian Lucas
Chartered Patent Agent
European Patent Attorney

contn:-

need not be replaced. In one aspect, the present invention attempts to provide a screen assembly to replace a known screen assembly of the pre-tensioned type.

5 The present invention also attempts to provide a panel for a screen, which will increase the life of layers of screening material arranged thereon.

10 The present invention also attempts to retain rigidity in the screen assembly, whilst being easy to replace.

15 In accordance with the present invention, there is provided a screen assembly for a shale shaker, the screen assembly comprising a panel and a support structure, the panel having an area provided with a multiplicity of apertures and at least one layer of screening material arranged over the multiplicity of apertures, the panel further comprising at least one support rib characterised in that said panel is removable from said support structure and wherein at least one member is arranged between said panel and said support structure within the perimeter of said panel over which said at least one support rib and said panel is deflectable, such that at least two spans are defined by said panel. The layers of screening material are the most likely components of a screen assembly to fail in use. A screen assembly of the present invention allows replacement of the panel with layers of screening material attached thereto, without having to replace the entire screen assembly. It has been noted that a replaceable screen support is friendlier to the environment, as only the panel and worn layers of screening material need be sent for recycling and the screen support be reused on site.

25 Preferably, the support structure is removable from said shale shaker. Advantageously, the screen assembly is insertable into a clamping mechanism of a shale
35

shaker. Advantageously, the panel has a perimeter, at least part of which, in use is arranged in the clamping mechanism and is pushed on to the support structure when operated.

5 Preferably, the at least one member is arranged substantially centrally such that the panel has at least two distinct screening areas, the at least two distinct areas have half the free span between fixing points, which in the case of the VSM 300 brand shale shaker sold
10 by Varco limited, is between the two side rails. By reducing the span by half, the rigidity of the screen assembly can be reduced proportionally by a much greater amount. Accordingly, the screen assembly can be made much lighter, as less of the same material is required. Hence
15 a reinforced screen panel is suitable in combination with a rigid support structure providing the support member.

 Advantageously, at least one of the support structure and the panel comprises the member over which the panel is deflectable in use. Most preferably, the
20 member is rigidly fixed support structure and/or the panel. Preferably, the support structure comprises a structural support member and the panel comprises a corresponding support member, which engage or co-operate to form a member over which the panel is deflectable in
25 use. Advantageously, one of the structural support member and the support member has a convex rounded profile and the other has a corresponding concave rounded profile. The support member and structural support member may be formed to co-operate to allow slight movement to
30 facilitate deflection of the panel over the support member and/or to facilitate location of the panel on to the support structure. It is important to provide means for the user to facilitate location of the panel over the support structure accurately so that downward force
35 provided by the fixing means in the shale shaker,

preferably an inflatable bladder or wedges, will properly fix the panel in the shale shaker. An interface is provided at the front end and back end of the panel, which may facilitate proper location of the panel over the support structure by abutting an adjacent screen or an interface means provided in the shale shaker. The interface may also facilitate sealing between panel to inhibit particles passing between screens and through interfaces.

10 Advantageously, the structural support member comprises a bar or tube extending across a substantial portion of the structural support. The structural support preferably extends along the entire length of the panel. The structural support member may comprise a square, 15 oblong, triangular or circular section bar or tube.

 Preferably, the support member comprises portions having openings therein. The openings advantageously allow fluid and small particles to flow through the openings. The openings also reduces the overall weight of 20 the panel.

 The panel may take the form of a rectangle or a circle. Preferably, the panel is rectangular having a pair of opposing sides and a pair of opposing ends, wherein the part of the perimeter is the two opposing 25 sides.

 Advantageously, the member is arranged equidistant the two opposing sides and is arranged substantially parallel to the two opposing sides. The member is arranged substantially centrally such that the panel has 30 at least two distinct areas, the at least two distinct areas having half the free span between fixing points.

 Preferably, two support members are arranged between the two opposing sides and are arranged substantially parallel to the two opposing sides. Each of the two 35 members is preferably arranged approximately a third the

way along the free span between the two sides, such that the panel has at least three distinct areas, the at least three distinct areas having a third the free span between fixing points.

5 Advantageously, the structural support comprises an outer frame and cross members. The outer frame and cross members are preferably made from steel tubing of square or circular cross section and are advantageously welded together at the junctures.

10 Preferably, the panel comprises a perforate plate, the multiplicity of apertures therein. Advantageously, the panel comprises a flat plate which may be of mild steel, aluminium or a plastics material. The apertures may be punched out, drilled, cast or cut out with a laser
15 or saw.

 Preferably, the panel comprises at least one support rib. In a rectangular screen, the ribs are arranged between sides preferably to increase rigidity across the screen, although the ribs are considerably smaller than
20 for a screen assembly spanning the full distance between sides. The inherent rigidity of the panel must be equal or greater than the rigidity of a standard screen assembly designed to be held free between the two opposed side rails when arranged in the shaker in use, but can be
25 much less rigid when not in use: between a third and a quarter as rigid when a single centrally mounted member is used and between a ninth and a sixteenth of the rigidity with two members arranged at approximately evenly spaced intervals across the width of the panel.
30 Advantageously, the support rib is fixed to the perforate plate. Preferably, a multiplicity of the support ribs extend across the panel. Advantageously, the perforate plate comprises a series of panel ribs formed in the perforate plate, the support ribs aligned with and
35 underneath the panel ribs.

Preferably, the panel comprises folded portions. Advantageously, the folded portions are perimeter portions. The folded perimeter portions may be located along the sides of a rectangular panel, which may increase the rigidity of the panel. The folded portions may be located at the ends of a rectangular panel, which may be folded to increase the rigidity of the panel and also to provide an interface between adjacent panels or to provide a holder for a seal for an interface between adjacent panels.

Advantageously, the folded portions form the apertures. The folded portions may form flanges which increase the overall rigidity of the panel, especially if all or a substantial number of the apertures are formed in this way.

Preferably, the panel has side portions, which are not provided with apertures. In a shale shaker provided with inflatable bladders or wedges as means for fixing the screen assembly in the shale shaker, the side portions are blinded by the means.

Advantageously, the at least one layer of screening material is adhered to the side portions of the perforate plate. Preferably, the at least one layer of screening material is adhered to at least a portion of the perforate plate. Advantageously, the at least one layer of screening material is adhered to the area provided with apertures. Preferably, the panel further comprises a second layer of screening material of substantially the same mesh size. Advantageously, a coarse mesh backing screen is arranged between the at least one layer of screening material and the perforate plate. The coarse mesh backing screen may have larger openings and larger wires to support the screening material.

Preferably, the support structure comprises a plurality of support ribs on which, in use the panel is

pushed on to. Advantageously, the support structure has a crowned profile and the panel is pushed down over the support structure by a clamping mechanism at an outer perimeter of the panel. Preferably, the panel is semi-
5 flexible, preferably such that the panel may change shape when a force is applied to it by the clamping mechanism of the shale shaker. The clamping mechanism may provide a tonne of force over the side edges of the screen assemblies arranged in the shale shaker, which may cover
10 3 to 12m over 1 to 2cm in width through a pneumatic hose. Advantageously, the panel is flexible, wherein it is easy to apply the layers of screening material to the panel and a tension in the layers of screening material is held by the panel, advantageously, such that the panel does
15 not bend under then tension in the layers of screening material. Advantageously, wherein it is easy to transport the panel with at least one layer of screening material arranged thereon.

The present invention also provides a shale shaker
20 comprising a screen assembly of the invention, the shale shaker comprising a basket, a vibratory mechanism and a clamping mechanism for fixing the screen assembly to the basket. Preferably, the clamping mechanism firmly fixes the panel to the support structure. Advantageously, the
25 clamping mechanism comprises a pneumatic means. Preferably, the pneumatic means comprises a pneumatic hose. Alternatively, a hydraulic hose could be utilized and preferably, provided with an accumulator.

The present invention also provides a method for
30 fitting a screen assembly in a shale shaker, the screen assembly comprising a panel having at least one layer of mesh thereon and a support structure, the panel further comprising at least one support rib arranged, the method comprising the steps of inserting the screen assembly
35 into a clamping mechanism of a shale shaker, operating

the clamping mechanism wherein at least part of a
perimeter of said panel of said screen assembly is pushed
down over at least one member arranged within the
perimeter of the panel such that the at least one support
5 rib and the panel is deflected over the at least one
member to define at least two spans.

CLAIMS

1. A screen assembly for a shale shaker, the screen assembly comprising a panel (500;800) and a support structure (600;700), the panel (401;500;800) having an area (307) provided with a multiplicity of apertures (504) and at least one layer of screening material (502) arranged over the multiplicity of apertures (504), the panel further comprising at least one support rib (505) characterised in that said panel (500;800) is removable from said support structure (500;800) and wherein at least one member (605,606,518,519;701,801) is arranged between said panel (500;800) and said support structure (600;700) within the perimeter of said panel (500;800) over which said at least one support rib (505) and said panel (500;800) is deflectable, such that at least two spans are defined by said panel (500;800).
2. A screen assembly as claimed in Claim 1, wherein said support structure (600;700) is removable from said shale shaker.
3. A screen assembly as claimed in Claim 1 or 2, wherein said screen assembly is insertable into a clamping mechanism of a shale shaker.
4. A screen assembly as claimed in Claim 3, wherein at least part of said perimeter of said panel (500;800), in use is arranged in said clamping mechanism and is pushed on to said support structure when operated.
5. A screen assembly as claimed in any preceding claim, wherein at least one of said support structure (600;700) and said panel (500;800) comprises said at least one member (605,606,518,519;701,801) over which said panel is deflectable in use.
6. A screen assembly as claimed in Claim 5, wherein said support structure (600;700) comprises a structural support member (605,606;701) and said panel (500;800) comprises a corresponding support member (518,519;801),

which engage to form said at least one member over which said panel is deflectable.

5 7. A screen assembly as claimed in Claim 6, wherein one of said structural support member (605,606;701) and said support member (518,519;801) has a convex rounded profile and the other has a corresponding concave rounded profile.

10 8. A screen assembly as claimed in Claim 6 or 7, wherein said structural support member (605,606;701) comprises a bar or tube extending across a substantial portion of said structural support.

9. A screen assembly as claimed in Claim 6, 7 or 8, wherein said support member (518,519;801) comprises a portions having openings therein.

15 10. A screen assembly as claimed in any of preceding claim, wherein said panel (500;800) is rectangular having a pair of opposing sides and a pair of opposing ends, wherein said part of said perimeter is said two opposing sides.

20 11. A screen assembly as claimed in Claim 10, wherein said at least one member (605,606,518,519;701,801) is arranged equidistant said two opposing sides and is arranged substantially parallel to said two opposing sides.

25 12. A screen assembly as claimed in Claim 10, comprising two support members (605,606,518,519) arranged between said two opposing sides and is arranged substantially parallel to said two opposing sides.

30 13. A screen assembly as claimed in any preceding claim, wherein said structural support (600;700) comprises an outer frame and cross members.

14. A screen assembly as claimed in any preceding claim, wherein said panel (500;800) comprises a perforate plate, said multiplicity of apertures therein.

35 15. A screen assembly as claimed in Claim 15, wherein

said panel comprises a flat punched plate.

16. A screen assembly as claimed in any preceding claim, wherein said panel (500) comprises a multiplicity of support ribs (505).

5 17. A screen assembly as claimed in Claim 15, wherein said support rib (505) is fixed to said perforate plate (501)

18. A screen assembly as claimed in Claim 16, wherein said multiplicity of said support ribs (505) extend
10 across said panel (500).

19. A screen assembly as claimed in Claim 18, wherein said perforate plate (501) comprises a series of panel ribs (503a) formed in said perforate plate (501), said support ribs (505) aligned with and underneath said panel
15 ribs (503a).

20. A screen assembly as claimed in any preceding claim, wherein said panel (500) comprises folded portions (508,509,511,512).

21. A screen assembly as claimed in Claim 20, wherein
20 said folded portions (508,509,511,512) are perimeter portions.

22. A screen assembly as claimed in Claim 20 or 21, wherein folded portions form said apertures.

23. A screen assembly as claimed in any preceding Claim,
25 wherein said at least one layer of screening material (502) is adhered to at least a portion of said panel (500).

24. A screen assembly as claimed in any preceding Claim, wherein said panel (500) has side portions (508,509),
30 which are not provided with apertures.

25. A screen assembly as claimed in Claim 24, wherein said at least one layer of screening material (502) is adhered to said side portions of said panel.

26. A screen assembly as claimed in any preceding claim,
35 wherein said at least one layer of screening material

(502) is adhered to said area provided with apertures.

27. A screen assembly as claimed in any preceding claim, further comprising a second layer of screening material of substantially the same mesh size.

5 28. A screen assembly as claimed in any preceding claim, further comprising a coarse mesh backing screen between said at least one layer of screening material and said panel.

10 29. A screen assembly as claimed in any preceding claim, wherein said support structure comprises a plurality of support ribs on which, in use the panel is pushed on to.

30. A screen assembly as claimed in Claim 29, wherein said support structure has a crowned profile and said panel is pushed down over the support structure by a
15 clamping mechanism at an outer perimeter of the panel.

31. A screen assembly as claimed in any preceding claim, wherein said panel is flexible.

32. A screen assembly as claimed in Claim 31, wherein said at least one layer of screening material is
20 tensioned over said panel wherein tension in said at least one layer of screening material is held by the panel.

33. A screen assembly as claimed in Claim 32, wherein the panel does not bend under then tension in said at
25 least one layer of screening material.

34. A shale shaker comprising a screen assembly as claimed in any of Claims 1 to 33, the shale shaker further comprising a basket, a vibratory mechanism and a clamping mechanism (654,655;754,755) for fixing the
30 screen assembly to the basket.

35. A shale shaker as claimed in Claim 34, wherein said clamping mechanism (654,655;754,755) firmly fixes the panel (500;800) to the support structure (600;700).

36. A shale shaker as claimed in Claim 34 or 35, wherein
35 said clamping mechanism comprises a pneumatic means.

37. A shale shaker as claimed in Claim 36, wherein said pneumatic means comprises a pneumatic hose.

38. A method for fitting a screen assembly in a shale shaker, the screen assembly comprising a panel having at least one layer of mesh thereon and a support structure, the panel further comprising at least one support rib arranged, the method comprising the steps of inserting the screen assembly into a clamping mechanism of a shale shaker, operating the clamping mechanism wherein at least part of a perimeter of said panel of said screen assembly is pushed down over at least one member arranged within the perimeter of the panel such that the at least one support rib and the panel is deflected over the at least one member to define at least two spans.

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